PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appeal No. _____

Application No.:	10/689,001
Filing Date:	October 20, 2003
Appellants:	Gayatri Vyas et al.
Group Art Unit:	1795
Confirmation No.:	4101
Examiner:	Raymond Alejandro
Title:	ELECTRICAL CONTACT ELEMENT AND BIPOLAR PLATE
Attorney Docket:	8540G-000236/US/COA (GP-300791)

REPLY BRIEF TO EXAMINER'S ANSWER

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Sir:

This Reply Brief is a reply to the Examiner's Answer mailed August 18, 2009 and further supports Appellants' Appeal Brief filed on July 13, 2009 appealing the rejections of claims 1-22 and 55-58 by the Patent Examiner in the Final Office Action mailed March 9, 2009.

STATUS OF THE CLAIMS

Claims 1-25, 29-53 and 55-58 are currently pending in the application. Of these claims, claims 23-25 and 29-53 are withdrawn, and claims 1-22 and 55-58 stand rejected. Claims 1-22 and 55-58 are the subject of this appeal.

For the Board's convenience, claims 1-22 and 55-58 are reproduced below in Appendix A. These claims have not been changed from the claims attached as Appendix A to the Appeal Brief.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner has rejected all of the claims subject to this appeal under 35 U.S.C. § 103(a) over the combination of either U.S. Patent No. 5,624,769 ("Li '769") or U.S. Patent No. 7,005,205 ("Gyoten '205") in view of U.S. Patent No. 4,146,657 ("Gordon '657").

Appellants' Appeal Brief correctly sets forth the specific grounds of rejection to be reviewed on appeal.

ARGUMENTS

Appellants have provided detailed arguments and identified the evidence relied upon in support of the patentability of the claims on appeal in the Appeal Brief. The evidence includes the references relied upon by the Examiner, Li '769, Gyoten '205, Gordon '657, and a Declaration ("Vyas Declaration") submitted under 37 C.F.R. § 1.132 and signed by inventor Gayatri (Vyas) Dadheech. In view of the detailed arguments already provided, Appellants address below only a few of the Examiner's assertions set forth in the Examiner's Answer.

1. The Examiner incorrectly concludes that it would have been obvious to use the specific fluorine doped tin oxide of Gordon '657 in the electro-chemical cells of Li '769 and Gyoten '205 to reject claims 1-22 and 55-58 under 35 U.S.C. § 103.

The Examiner admits that neither Li '769, nor Gyoten '205, discloses an electrically conductive coating that includes a doped metal oxide composition as required by independent claims 1 and 55. See Examiner's Answer, Page 10, Lines 2-3. However, the Examiner asserts that it would have been obvious to use the specific fluorine doped tin oxide of Gordon '657 in the electro-chemical cells of Li '769 and Gyoten '205. See Examiner's Answer, Page 7, Lines 13-17 and Page 11, Lines 3-7.

In making the rejection of claims 1 and 55, the Examiner asserts that the fuel cell structure disclosed by Li '769 "fully supports having a non-ferrous metal-oxide coating" on the contact elements of the fuel cell. See Examiner's Answer, Page 5, Lines 6-8. However, portions of Li '769 cited by Appellants actually suggest the undesirability of metal oxide layers on the surfaces of the contact elements of a fuel cell, and therefore teach away from the coating recited in claims 1 and 55. See Appeal Brief, Section A.1.(a), Pages 11-13. Additionally, Appellants have demonstrated that the Examiner's assertion contradicts the conventional approach in the field of fuel cell design at the time of discovery. The conventional approach had been to apply anti-corrosive coatings, such as the TiN coating disclosed by Li '769, on the contact elements to minimize the formation of metal oxide layers. See Appeal Brief, Section A.1.(a), Pages 12-13; Vyas Declaration, Page 4, Paragraphs 12 and 14 and Page 5, Paragraph 16.

In sum, Appellants have convincingly shown that Li '769 *does not* support having a metal-oxide coating, non-ferrous or otherwise, when properly considered in its entirety, and the Examiner's assertion should be rejected. In fact, Li '769, consistent with the conventional approach at the time of the invention, teaches away from a metal-oxide coating and coatings including a doped metal oxide composition as recited in Appellants' claims.

In making the rejection, the Examiner further asserts that it would have been obvious to use the specific fluorine doped tin oxide of Gordon '657 in the fuel cell structure of Li '769 and Gyoten '205 because "Gordon directly teaches that such specific oxide films find application in electrochemical systems or environments due to their high electrical conductivity and suitable thermal expansion coefficient." See Examiner's Answer, Page 7, Lines 13-17.

However, Appellants have shown that the applications, objects, and details of Gordon '657 do not provide a sound foundation for concluding Gordon '657 teaches the applicability or suitability of doped metal oxide compositions to fuel cells. In particular, Gordon '657 fails to address the knowledge held by skilled artisans at the time of the invention that un-doped tin oxides, like other metal oxides, were commonly known to be unstable in the fuel cell environment. Additionally, Appellants have shown that the Examiner's rationale, like Gordon '657, fails to address the technical challenges introduced by the significant differences that exist between the environments and substrate materials of a fuel cell (claimed subject matter and subject matter of Li '769 and Gyoten '205) and those of Gordon '657 (e.g., solar cells). See, for example, Appeal Brief, Section A.1.(c), Pages 15-16.

The Examiner asserts that *KSR* "forecloses the argument that a specific teaching, suggestion or motivation is required to support a finding of obviousness." See Examiner's Answer, Page 8, Lines 1-6. However, the Examiner's assertion does not answer the question whether Appellants' claims are obvious in view of the cited art. Under the proper analysis, it must be shown that the claimed invention would have been obvious to one of ordinary skill in the art after consideration of all the facts. 35 U.S.C. § 103; M.P.E.P. § 2141. The Examiner's rejection of Appellants' claims must be overturned because Appellants' arguments and evidence of record establish by the preponderance of the evidence that the combined teachings of Li '769, Gyoten '205, and Gordon '657 would not have suggested the structure for a fuel cell recited in Appellants' claims. The Examiner has reached an improper conclusion by failing to consider the references as a whole and by failing to give due weight to Appellants' arguments and evidence of record.

The Examiner has failed to give due weight to Appellants' contention that Gordon '657 fails to teach or suggest applying doped metal oxide coatings to the substrates of fuel cells, at least in part, because the Examiner asserts that Appellants have failed to meet the burden of proving the point by failing to provide objective, sound, or scientific evidence. See Examiner's Answer, Page 16, Lines 3-8. Rather than give Appellants' evidence due weight, the Examiner improperly dismisses Appellants' evidence. Appellants' evidence includes citations to material portions of the same prior art references relied upon by the Examiner and Appellants' own declaration evidence. Certainly, material portions of the prior art references must be considered objective evidence. Additionally, under present practice, Appellants' own declaration evidence, is given due weight. "Although an affiant's or declarant's opinion on the ultimate legal issue is not evidence in the case, "some weight ought to be given to a persuasively supported statement of one skilled in the art on what was not obvious to him." M.P.E.P. § 716.01(c) citing *In re Lindell*, 385 F.2d 453, 155 U.S.P.Q. 521 (C.C.P.A. 1967). An affidavit of an applicant as to the advantages of his or her claimed invention, while less persuasive than that of a disinterested person, cannot be disregarded for this reason alone. M.P.E.P. § 716.01(c); *Ex parte Keyes*, 214 U.S.P.Q. 579 (Bd. App. 1982); *In re McKenna*, 203 F.2d 717, 97 U.S.P.Q. 348 (C.C.P.A. 1953).

In view of the evidence presented by Appellants and present practice, the Examiner's contention that the Appellants have failed to provide objective, sound, or scientific evidence in support of Appellants' contentions must be rejected.

2. The Examiner improperly asserts that "Gordon addresses the same technical difficulties confronted by both Li et al and [A]ppellant including a reduction in electrical resistance in electrical or power generation applications as a basis for asserting the obviousness of Appellants' claims.

Appellants respectfully disagree with the Examiner. Contrary to the position taken by the Examiner (see Examiner's Answer, Page 7, Line 21 to Page 8, Line 1), Gordon '657 does not address the same technical difficulties confronted by Appellants. Therefore, the Examiner has improperly relied upon this fact as a basis for combining Gordon '657 with Li '769 and Gyoten '205 to reject Appellants' claims.

The Examiner fails to recognize the specific technical difficulties confronted by Appellants, as well as Li '769 and Gyoten '205. Instead the Examiner relies upon an overly broad characterization as a basis for asserting the obviousness of Appellants' claims. Simply put, the Examiner's broad definition of the problem to be solved oversimplifies the technical difficulties confronted by Appellants and forms an insufficient basis for asserting the obviousness of Appellants' claims over Li '769 and Gyoten '205 in view of Gordon '657, particularly in view of Appellant's declaration evidence.

Appellants have shown that the problem confronted by Appellants cannot be characterized as merely providing a conductive layer providing a reduction in electrical resistance. See Appeal Brief, Section A.1.(c), Pages 15-16. Importantly, the technical problem to be solved includes providing a conductive coating on the contact element exhibiting low contact resistance and providing anti-corrosive properties that inhibit electrical degradation of the conductive coating when exposed to the environment of the fuel cell. See Vyas Declaration, Page 5, Paragraph 17.

While Gordon '657 may be concerned with providing a suitable electrically conductive coating to reduce electrical resistance in power generating devices such as a solar cell, Gordon '657 was neither confronted with, nor concerned with the unique technical problems of electrical degradation presented by the caustic environment of a fuel cell. Additionally, Gordon '657 neither discloses, nor suggests using the disclosed process to deposit the coating on the metallic substrates disclosed in Li '769 and typically used in fuel cells, such as stainless steel, aluminum, and titanium. Moreover, while Gordon '657 may disclose a good match between the thermal expansion coefficient of Gordon's coatings and the silicon-based substrates to which the coatings are applied, these teachings are not helpful to assessing the applicability of the coatings to the metal substrates disclosed by Li '769 and typically used in fuel cells. In view of these significant deficiencies, Gordon '657 falls well short of addressing the same technical difficulties confronted by the primary references, Li '769 and Gyoten '205, and Appellants.

3. The Examiner improperly accuses Appellants of "selectively picking-and-choosing" claim terms and definitions.

Appellants have not selectively picked or chosen convenient interpretations for the terms of the claims. See Examiner's Answer, Page 16, Line 15 to Page 17, Line 2. Rather, Appellants have shown that the meaning of the foregoing terms is clear and unambiguous from the written description, claims, and drawings in the application as originally filed. Appellants have further shown that the meanings are consistent with the plain and ordinary meanings set forth in Merriam-Webster's Collegiate Dictionary 270 (11th ed. 2005). See Appeal Brief, Section A.1.(d), Pages 24-25.

The Examiner, on the other hand, fails to articulate any rationale for adopting alternate meanings of the foregoing claim terms. Importantly, the Examiner fails to resort to Appellants' specification and/or other extrinsic evidence, such as a dictionary, to support his contention.

In sum, Appellants have not selectively picked or chosen convenient interpretations for the terms of the claims and thereby introduced "unclaimed limitations based upon meanings and definitions conveniently accommodated by the [A]ppellant" as alleged by the Examiner. See Examiner's Answer, Page 17, Lines 17-21. In view of the foregoing, the Examiner's allegation must be rejected.

4. The Examiner improperly concludes that "no unexpected result can be attributed to [Appellants'] electrochemical cell as instantly claimed because it does not contain the same elements/features found to impart unexpected results to the embodiment or fuel cell system described in the foregoing declaration."

Appellants respectfully disagree. Contrary to the position taken by the Examiner (see Examiner's Answer, Page 20, Line 12 to Page 21, Line 5), claims 1 and 55, either alone or in combination with the claims dependent therefrom, *do recite* the key elements and features found to impart the unexpected results.

As stated in Appellants' Declaration and explained in the Appeal Brief, the unexpected results include providing a stable (i.e., anti-corrosive) coating of tin oxide,

and metal oxides in general, on a conductive substrate used in a fuel cell that exhibits low contact resistance between the oxide layer, the adjoining substrate, and other adjoining surfaces of the fuel cell. Appellants have further explained that the conductive substrates used in fuel cells, as disclosed in Li '769 and Gyoten '205, are conventionally metallic substrates. The metallic substrates tend to oxidize in the presence of heat, such as that used by Gordon's process, causing a highly resistive oxide layer to form on the surface of the substrate. See Appeal Brief, Pages 25-27; Vyas Declaration, Pages 2-5, Paragraphs 6, 8, 13, and 18.

Claims 1 and 55 are limited to claiming a fuel cell. The preamble to the claims contains the language "fuel cell" and the body of the claims recites the primary structure that is expected of a fuel cell, such as a "solid polymer electrolyte having a permeable body containing a cation exchange membrane," and "electrode," "an electrically conductive contact element having a major working surface," and a "reactant gas." Further, dependent claims in the application include additional structure indicative of the claimed fuel cell, including the recitation of a "catalytic electrode" (e.g., claim 2), "a corrosive environment" of the fuel cell (e.g., claims 3, 58), a "fluid distribution element...comprising a flow field" (e.g., claim 13), "a series of channels" of a flow field (e.g., claim 18), a "flow field" comprising "lands defining a plurality of grooves for distributing fuel or oxidant" along the working surface (e.g., claims 19, 21).

Claims 1 and 55 also recite a coating that includes a doped metal oxide composition that provides a contiguous, protective layer on the contact element from direct contact with a reactant gas and provides electrical conductivity between the working surface of the contact element and an adjoining electrode. Claims 1 and 55 further recite the doped metal oxide composition has a resistivity of less than .001 ohm-cm.

Additionally, other dependent claims further limit and define the key elements and features recited in claims 1 and 55. In particular, claims 3 and 58 specify that the contact element comprises a metal substrate. Claims 2 and 14 specify the coating

comprises fluorine doped tin oxide. Claim 22 specifies a particular doping level that may be used to achieve the resistivity recited in claims 1 and 55.

In sum, claims 1 and 55, either alone or in combination with the claims dependent therefrom, do recite the key elements and features found to impart the unexpected results. Accordingly, the Examiner's contention that no expected results can be attributed on Appellants' claims must be rejected.

II. CONCLUSION

Appellants respectfully request the Board to reverse the Examiner's rejection of the claims on appeal.

Should there be any outstanding matters that need to be resolved in the present Application, the Examiner is respectfully requested to contact the undersigned at the telephone number of the undersigned below.

Respectfully submitted,
HARNESS, DICKEY, & PIERCE, P.L.C.

/David A. McClaughry/

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APPENDIX A

CLAIMS APPENDIX

1. (Rejected) A fuel cell comprising:

a solid polymer electrolyte having a permeable body containing a cation exchange membrane;

an electrode in electrical communication with said electrolyte; and

an electrically conductive contact element having a major working surface facing said electrode that defines a plurality of reactant gas channels separated by a plurality of lands, said electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition which has a resistivity of less than .001 ohm-cm, and wherein said electrically conductive coating provides electrical conductivity between said plurality of lands and said electrode, and wherein said coating provides a protective layer on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels.

2. (Rejected) The fuel cell of Claim 1 wherein said electrode is a catalytic electrode on one major face of the membrane, and wherein said coating comprises fluorine doped tin oxide.

3. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a metal substrate which is susceptible to corrosion, and said coating is a corrosion-resistant protective coating which protects said metal substrate from a corrosive environment of the fuel cell.

4. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a substrate formed of electrically conductive particles dispersed in a binder matrix, and said coating provides electrical contact between said substrate and said electrode.

5. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a matrix of compacted graphite flakes impregnated with a filler.

6. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element comprises a conductive substrate, a layer of conductive open cell foam having a first face facing said substrate and a second face facing said electrode, and wherein said coating is deposited on and covers at least one of said first face or said second face of said foam layer.

7. (Rejected) The fuel cell of Claim 6 wherein said open cell foam has external surfaces and internal surfaces defined by openings in said open cell foam, and wherein said coating is deposited on and covers said internal and external surfaces.

8. (Rejected) The fuel cell of Claim 7 wherein said foam has a thickness between said first and second faces, and said coating is present on said internal and external surfaces throughout said thickness.

9. (Rejected) The fuel cell of Claim 8 wherein said coating is deposited on and covers a surface of said substrate facing said foam.

10. (Rejected) The fuel cell of Claim 6 wherein said substrate is a metal sheet and said foam is a metal foam.

11. (Rejected) The fuel cell of Claim 10 wherein said metal sheet is welded or braised to said metal foam.

12. (Rejected) The fuel cell of Claim 1 which further includes an electrically conductive porous material disposed between said electrode and said coated electrically conductive contact element, and wherein said porous material is selected from the group consisting of carbon paper, carbon cloth and metal screen.

13. (Rejected) The fuel cell of Claim 1 wherein said electrically conductive contact element is a fluid distribution element, comprising:

an electrically conductive substrate having first and second major working surfaces, and a flow field at said first major working surface for distributing fluid along

said first major working surface, and wherein said coating is deposited on and covers said first major working surface.

14. (Rejected) The fuel cell of Claim 13 wherein said coating comprises fluorine doped tin oxide.

15. (Rejected) The fuel cell of Claim 13 wherein said substrate is selected from the group consisting of titanium, stainless steel, aluminum, a composite of electrically conductive particles dispersed in a binder matrix; and compacted graphite flakes impregnated with a filler.

16. (Rejected) The fuel cell of Claim 13 wherein said flow field comprises a layer of electrically conductive open cell foam.

17. (Rejected) The fuel cell of Claim 16 wherein said foam is conductive graphite foam or conductive metallic foam.

18. (Rejected) The fuel cell of Claim 13 wherein said plurality of channels is formed in said first major working surface, and wherein said flow field comprises said plurality of channels in said first major working surface.

19. (Rejected) The fuel cell of Claim 13 wherein said flow field comprises said plurality of lands.

20. (Rejected) The fuel cell of Claim 13 which comprises a second flow field at said second major working surface.

21. (Rejected) The fuel cell of Claim 20 wherein said second flow field comprises a series of lands defining a plurality of grooves for distributing coolant fluid along said second major working surface.

22. (Rejected) The fuel cell of Claim 14 wherein the fluorine content of said fluorine doped tin oxide is less than 10 weight percent.

55. (Rejected) A fuel cell comprising a solid polymer electrolyte having a permeable body containing a cation exchange membrane, an electrode in electrical communication with said electrolyte, a gas diffusion member, and an electrically conductive contact element having a major working surface facing said electrode that defines a plurality of reactant gas channels separated by a plurality of lands, said electrically conductive contact element having an electrically conductive coating deposited on and contiguously covering said plurality of lands of said major working surface, wherein said electrically conductive coating includes a doped metal oxide composition which has a resistivity less than .001 ohm-cm, and wherein said coating is in direct contact with said gas diffusion member and provides electrical conductivity between said purality of lands and said electrode, and wherein said coating provides a

protective layer on said contact element from direct contact with a reactant gas in said plurality of reactant gas channels.

56. (Rejected) The fuel cell of Claim 55 wherein said coating comprises fluorine doped tin oxide.

57. (Rejected) The fuel cell of Claim 56 wherein the fluorine content of said fluorine doped tin oxide is less than 10 weight percent.

58. (Rejected) The fuel cell of Claim 55 wherein said electrically conductive contact element comprises a metal substrate which is susceptible to corrosion from said reactant gas and said coating is a corrosion-resistant protective coating which protects said metal substrate from a corrosive environment of the fuel cell.